Sustainable Universities & Colleges Symposium
October 28, 2011

Biomass Energy: Opportunities for Sustainability, Service, & Teaching

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Illinois Institute for Rural Affairs

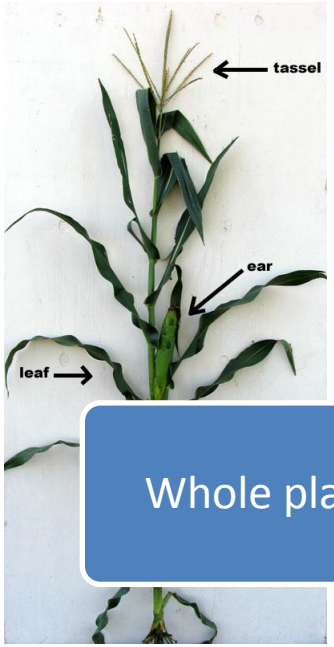
www.IIRA.org

WESTERN ILLINOIS UNIVERSITY

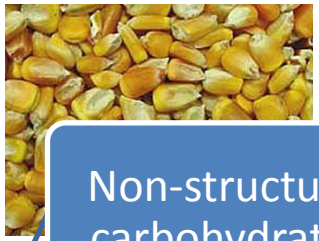
Illinois Institute for Rural Affairs

- Founded by Executive Order in 1989 as “State clearinghouse for rural development data and initiatives”
- Housed at Western Illinois University in Macomb
- Value-Added Sustainable Development Center leads ag & renewable energy efforts

What is biomass?

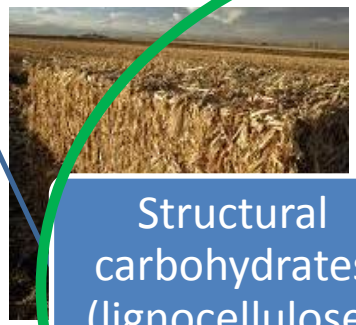


Whole plant



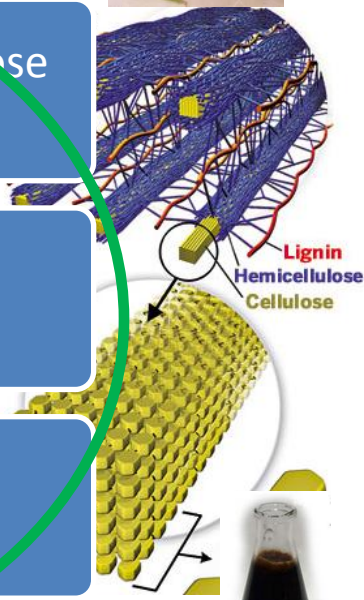
Non-structural carbohydrates

- Sugars
- Starches
- Oils



Structural carbohydrates (lignocellulose)

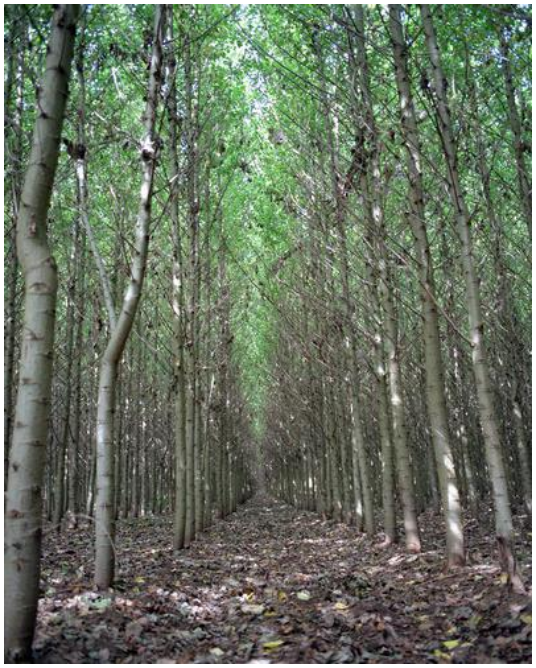
- Hemicellulose (NDF)
- Cellulose (ADF)
- Lignin



My definition of “biomass”

What are the major biomass feedstocks?

- Key platforms: crop residues, perennial grasses, and woody material.



Conservation value of perennials

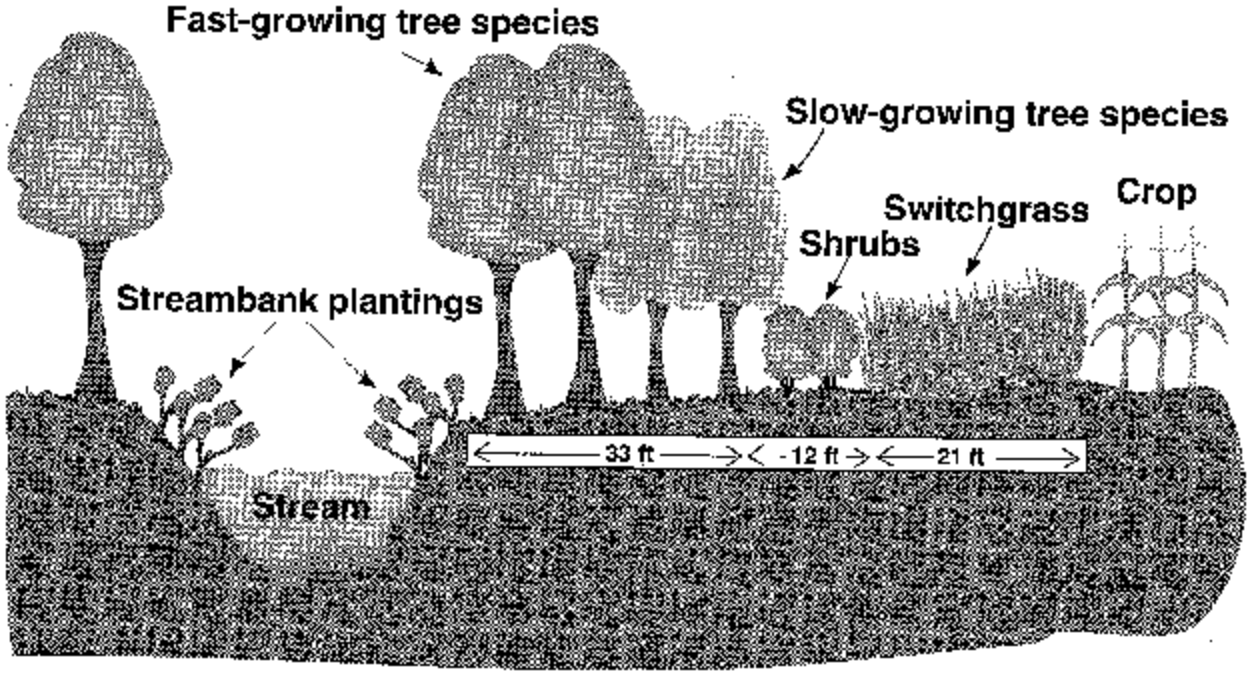
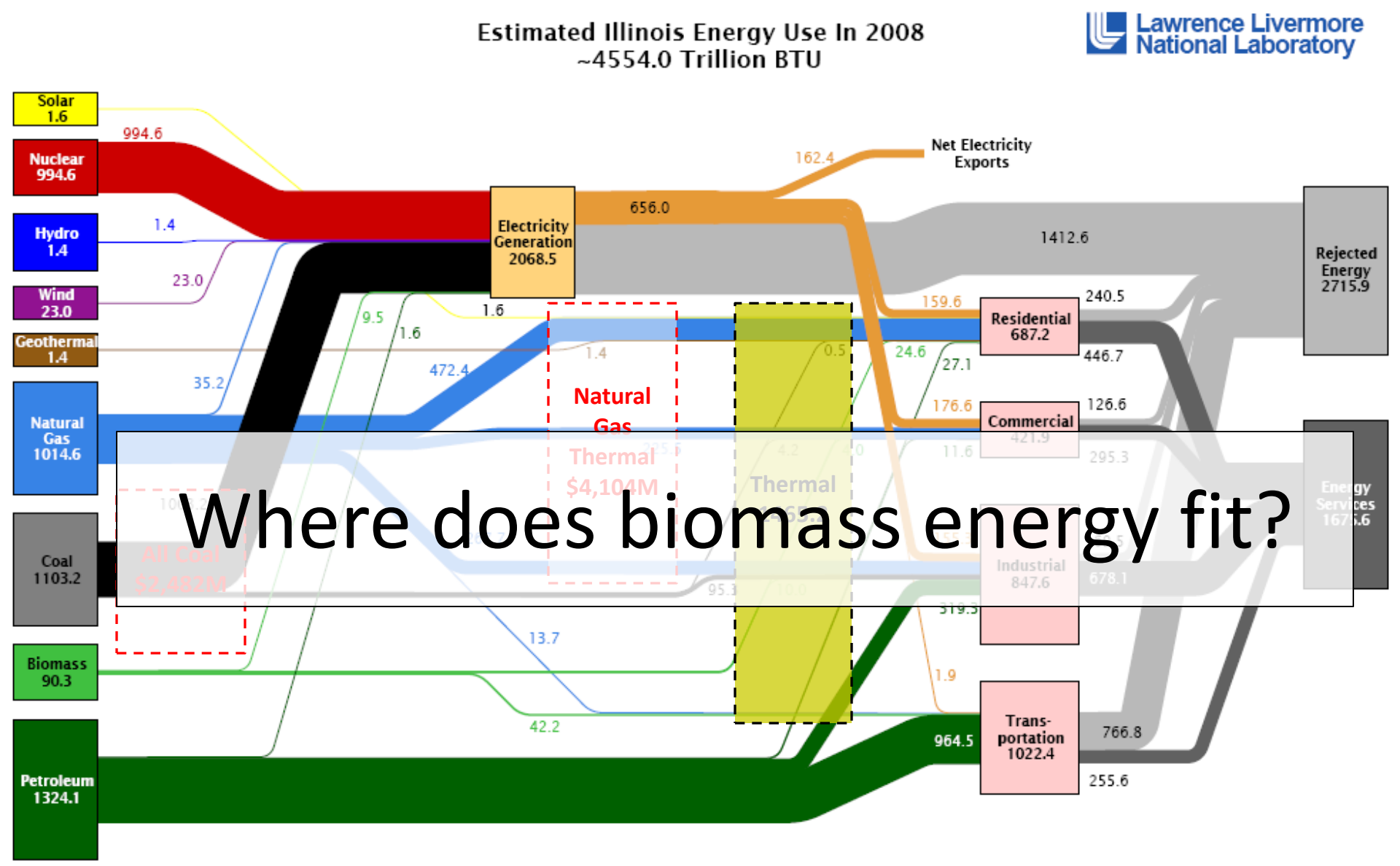


FIGURE 19.2.—The multispecies riparian buffer strip model includes tree rows closest to the stream, next to the trees, shrubs, and then a strip of switchgrass adjacent to the cropland.

p photograph shows site in March
e right side of the stream had been
. Bottom photograph shows same
arian vegetation and the dramatic
management.



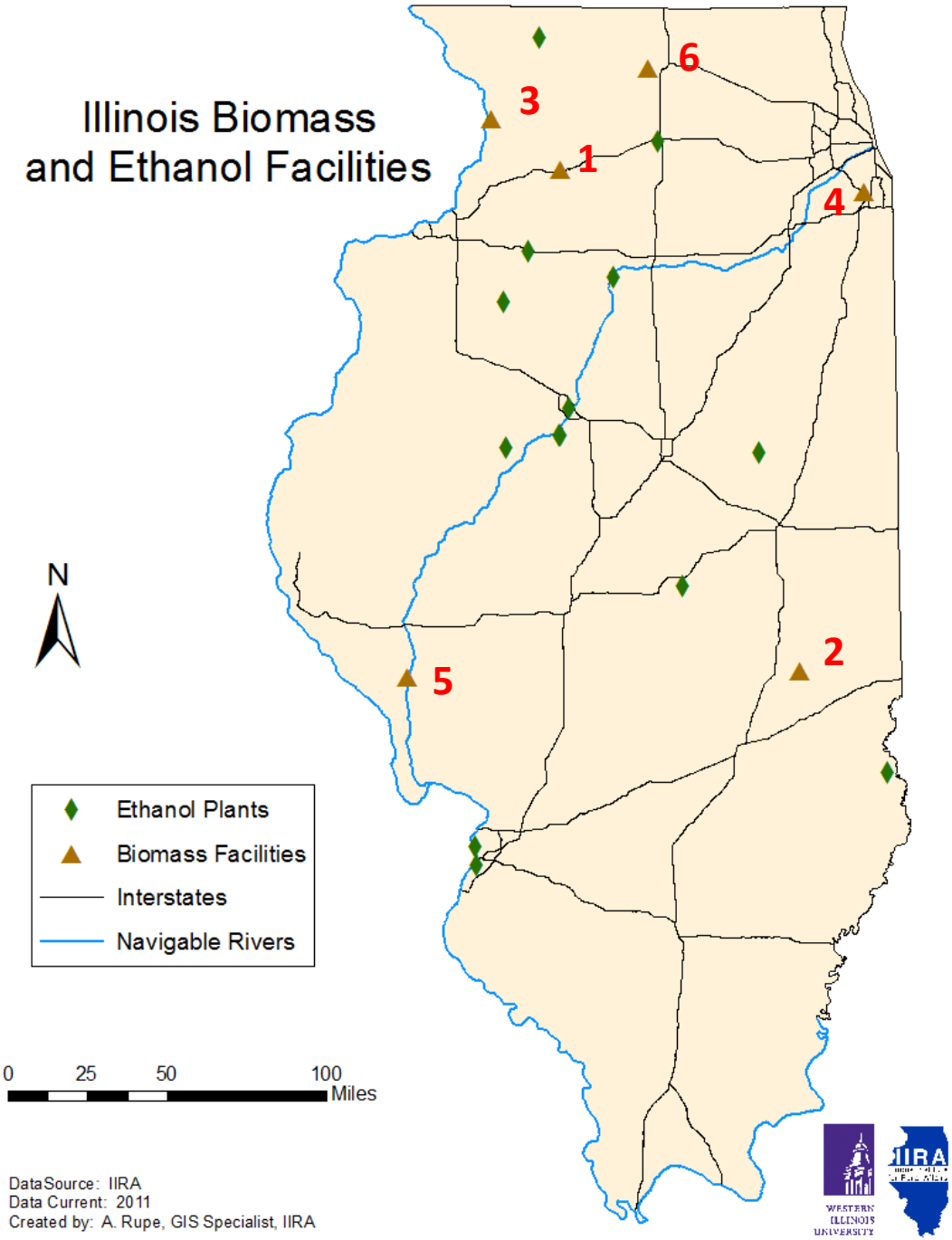
Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

http://flowcharts.llnl.gov/

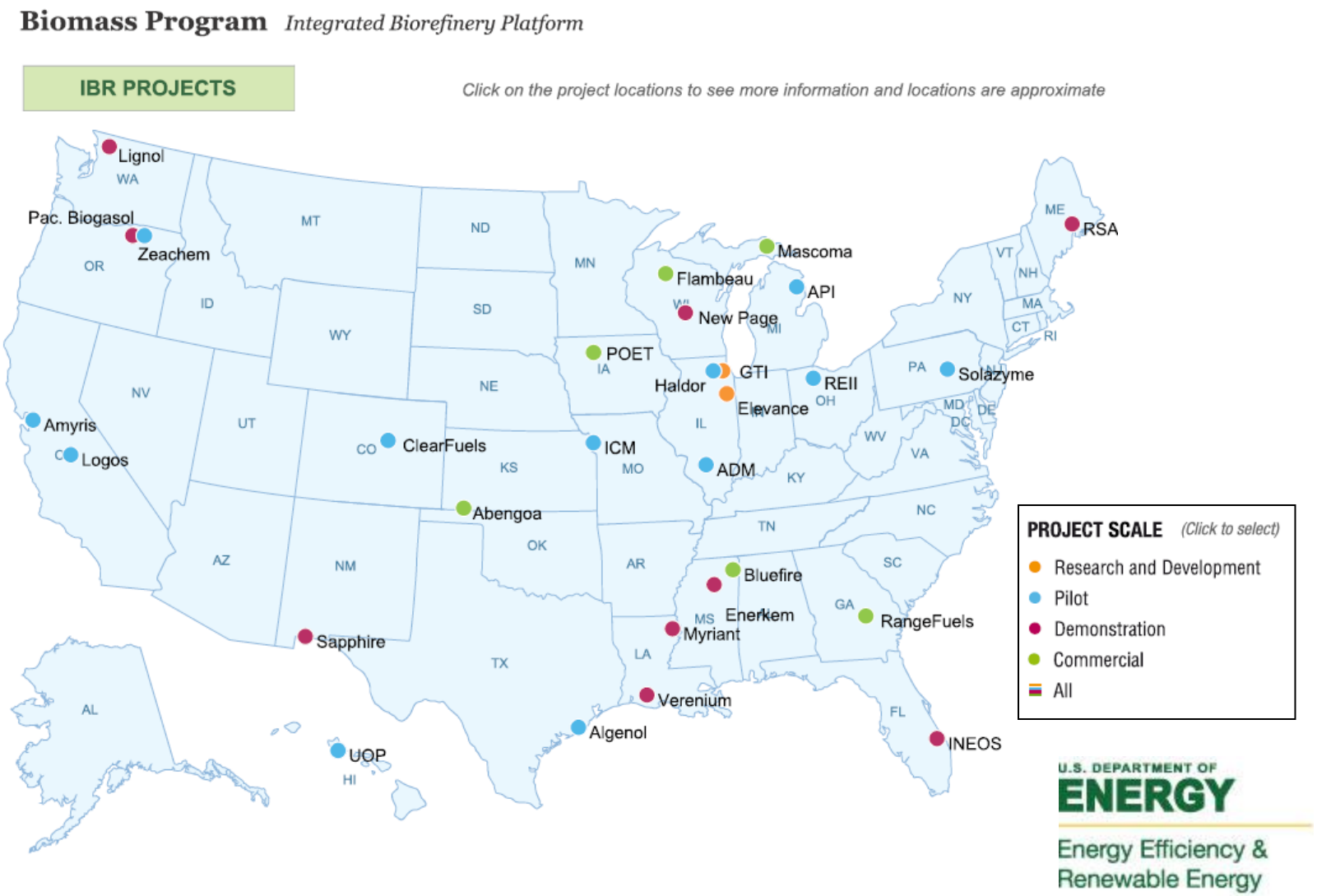
Price assumptions for coal and natural gas, respectively: $2.25 and $4.25/MMBTU

Biomass heat & power in IL

1. BioPro Rock Falls, 25 MW
2. EIU REC, heat
3. Jo-Carroll Energy, 20 MW
4. Robbins Comm. Power, 50 MW
5. Prairie Power, 22 MW 10% co-fire
6. Freedom Field, heat (small)



USDOE Integrated Biorefineries Program



http://www.eere.energy.gov/biomass/


Biomass on campus

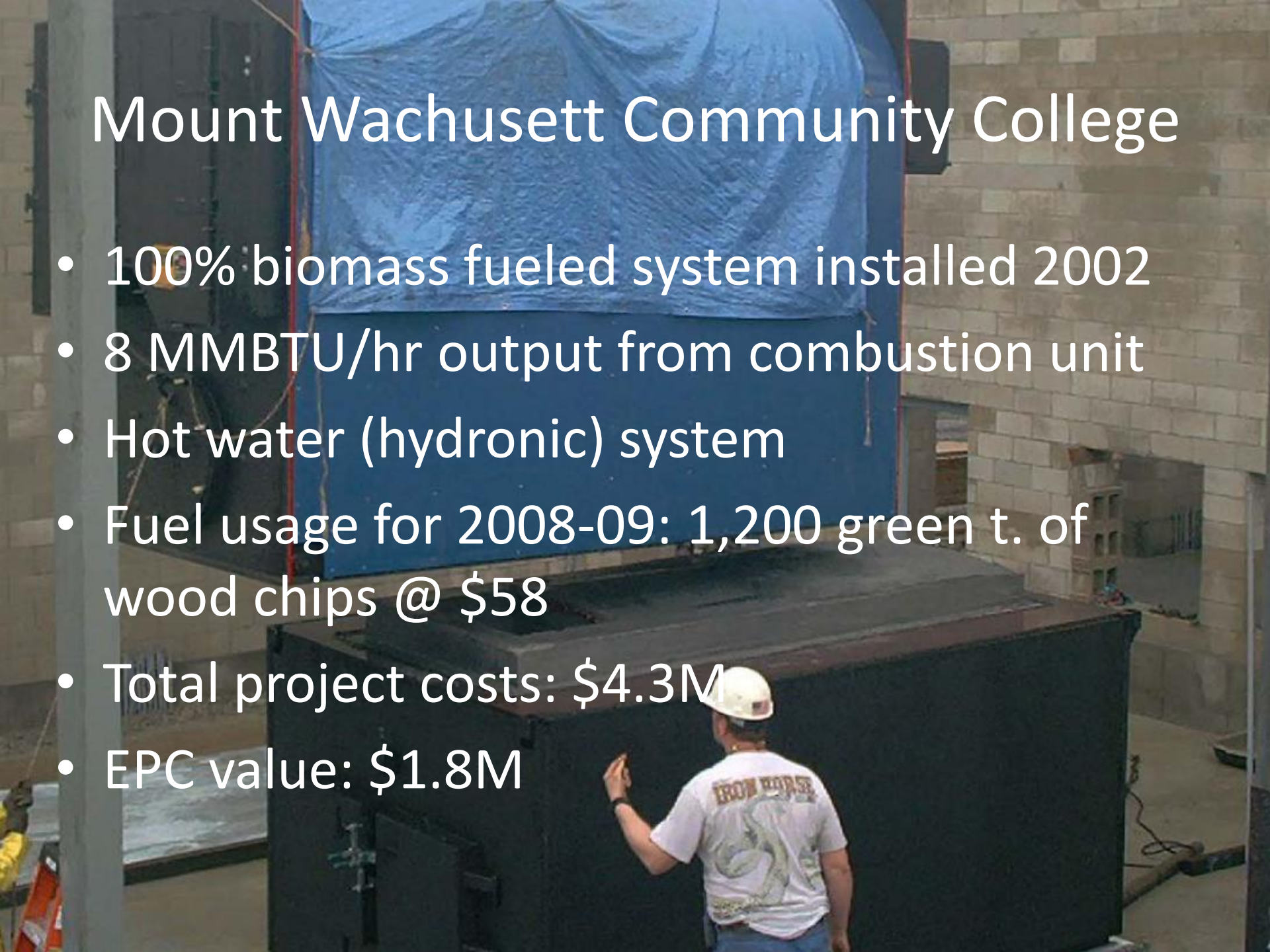
EIU Renewable Energy Center

MWCC

- MWCC located in Gardner, MA
- 450,000 ft^2 building complex to heat
- Previous system: electrical resistance heaters
- Feasibility study determined biomass competitive to fuel oil or natural gas
- Opportunity to leverage Energy Performance Contracting

Mount Wachusett Community College

- 100% biomass fueled system installed 2002
- 8 MMBTU/hr output from combustion unit
- Hot water (hydronic) system
- Fuel usage for 2008-09: 1,200 green t. of wood chips @ $58
- Total project costs: $4.3M
- EPC value: $1.8M



Mount Wachusett Community College

- Additional project: 50kW biomass combined heat & power (CHP) unit

MWCC website:
http://mwcc.edu/renewable/

A note on feedstock prices

- Natural gas is currently ~$4/MMBTU.
- Grass biomass contains ~16 MMBTU/t DM.
- …so a natural gas user can pay ~$62/t DM for grass biomass and stay cost neutral.

- This doesn't account for costs of converting to biomass, storage, processing, etc….
- …but also doesn't account for the sustainability and institutional image benefits of biomass.


Opportunities for outreach

USDA BCAP: Biomass Crop Assistance Program

FSA BIOMASS CROP ASSISTANCE PROGRAM

USDA FSA

FACT SHEET

UNITED STATES DEPARTMENT OF AGRICULTURE
FARM SERVICE AGENCY

October 2010

Biomass Crop Assistance Program (BCAP)

Overview

The Biomass Crop Assistance Program (BCAP), created in the 2008 Farm Bill, is a primary component of the domestic agriculture, energy, and environmental strategy to reduce U.S. reliance on foreign oil, improve domestic energy security, reduce carbon pollution, and spur rural economic development and job creation. BCAP provides incentives to interested farmers, ranchers and forest landowners for the establishment and cultivation of biomass crops for heat, power, bio-based products and biofuels.

BCAP will address a classic chicken-and-egg challenge: if commercial-scale biomass facilities are to have sufficient feedstocks, then an established, large-scale energy crop source must exist. Conversely, if profitable crop production is to occur, then a viable consumer base must exist to purchase the product.

With the enactment of the updated federal Renewable Fuels Standard, which requires 36 billion gallons of advanced biofuels in the national fuel supply by 2022, new crops must keep pace with these revised federal targets. Many bioenergy crops need several years to become established. Many bioenergy facilities need several years to reach commercial scale. BCAP serves as a catalyst to unite these multiple dynamics by reducing the

- Crop producers and bioenergy producers will be able to team together to submit applications to USDA to be selected as a BCAP project area.
- If selected, crop producers will be eligible for reimbursements of up to 75 percent of the cost of establishing a bioenergy perennial crop. Producers also can receive up to 5 years of annual payments for grassy crops (annual or perennial), and up to 15 years of annual payments for woody crops (annual or perennial).
- Assistance for the collection, harvest, storage and transportation of biomass to biomass conversion facilities will be available for 2 years, per producer, in the form of a matching payment for up to $45 per ton of the delivery cost to the facility.

Highlights

- **Expenditures**

During the Notice of Funding Availability (NOFA) period, $250 million was expended during roughly one quarter year of BCAP matching payments. Refinements to the BCAP final rule has the BCAP cost-benefit analysis estimating that total expenditures over 15 years will be $461 million.

- **Blue, White and Green-Collar Job Creations:**

impact from implementation to be an estimated $88.5 billion in economic activity.

- **New Energy Crop Feedstocks**

BCAP will reduce the financial risk of producers who support emerging biofuels markets. Crops include, but are not limited to, switchgrass, miscanthus, fast-growing woody poplar, jatropha, algae, energy cane, and pongamia.

- **Enhanced stewardship and conservation measures**

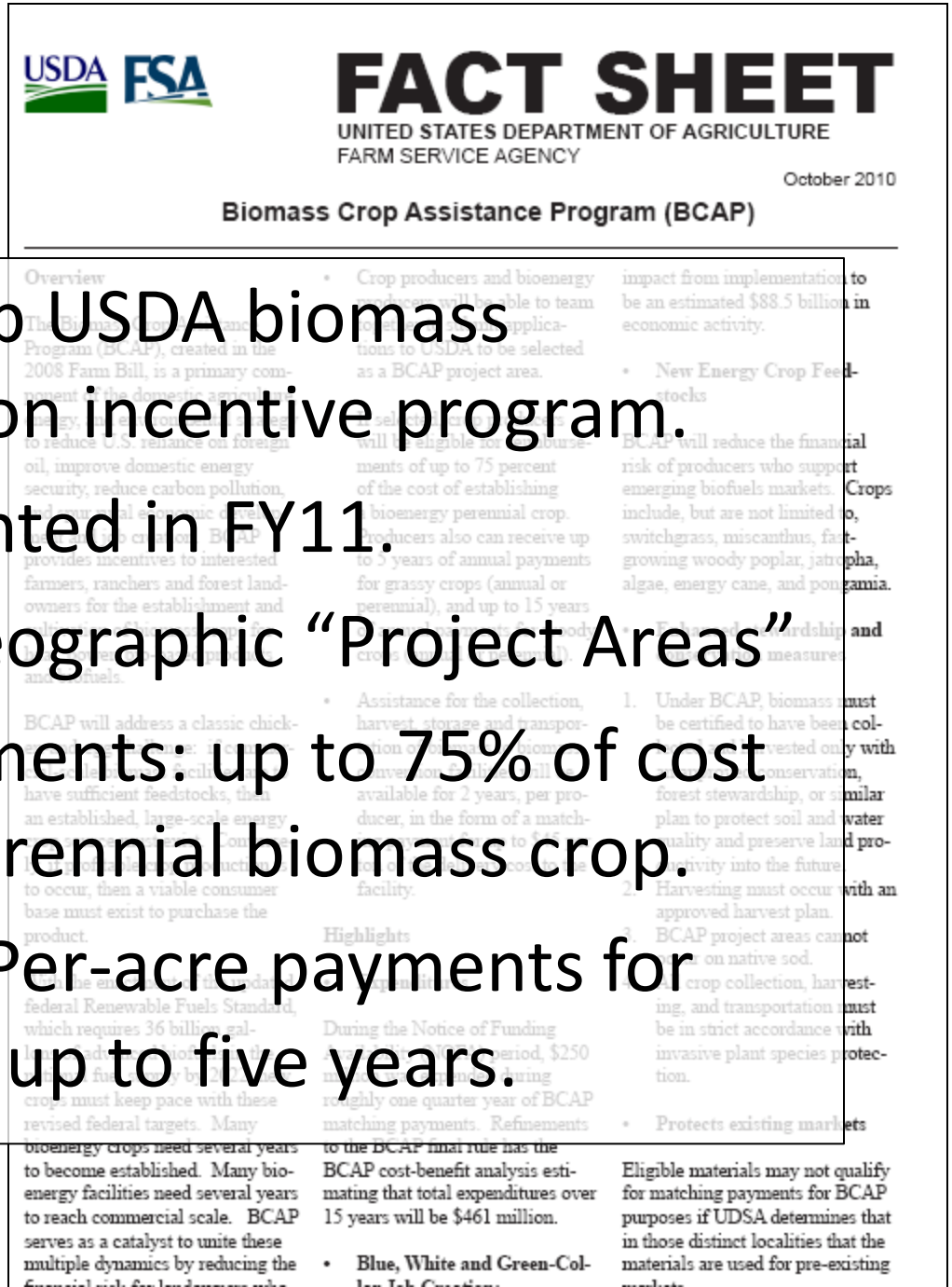
1. Under BCAP, biomass must be certified to have been collected and harvested only with an approved conservation, forest stewardship, or similar plan to protect soil and water quality and preserve land productivity into the future.
2. Harvesting must occur with an approved harvest plan.
3. BCAP project areas cannot occur on native sod.
4. All crop collection, harvesting, and transportation must be in strict accordance with invasive plant species protection.

- **Protects existing markets**

Eligible materials may not qualify for matching payments for BCAP purposes if UDSA determines that in those distinct localities that the materials are used for pre-existing

BCAP

- Intended as flagship USDA biomass feedstock production incentive program.
- First fully implemented in FY11.
- Revolves around geographic “Project Areas”
- Establishment payments: up to 75% of cost of establishing a perennial biomass crop.
- Annual payments: Per-acre payments for perennial crops for up to five years.



USDA FSA

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Biomass Crop Assistance Program (BCAP)

Prairie State Biomass team

~24 farmers:

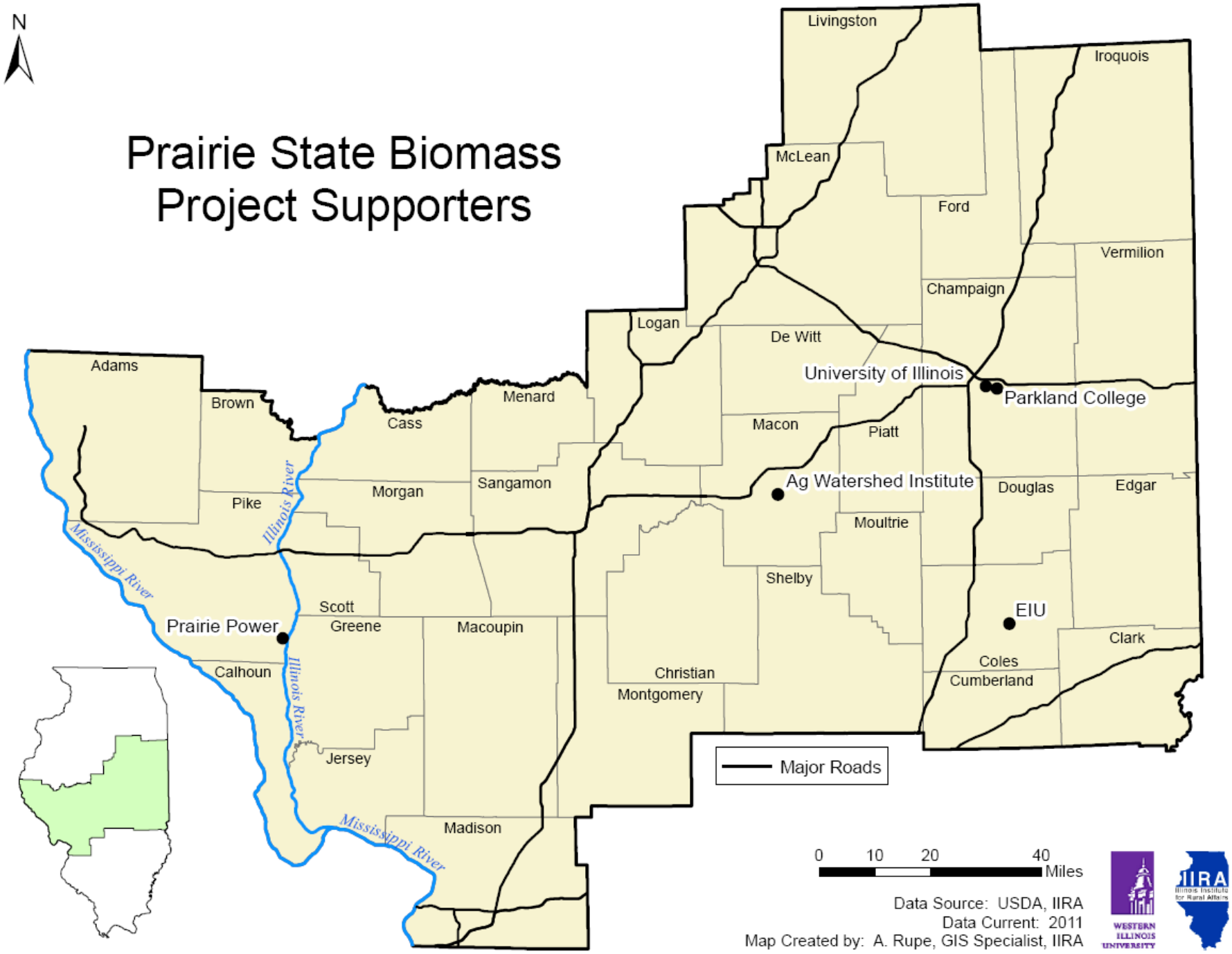
- Prairie State Biomass Producers Association, chaired by Eric Rund of Pesotum, IL, and including including Omni-Ventures group from western Illinois.

Three committed biomass conversion facilities:

- Prairie Power, Inc.
- Parkland College
- Ag Watershed Institute, Community Supported Energy network

Two supporting biomass conversion facilities:

- University of Illinois at Urbana-Champaign
- Eastern Illinois University


N
Prairie State Biomass Project Supporters
Livingston
Iroquois
McLean
Ford
Vermilion
Champaign
Logan
De Witt
University of Illinois
Parkland College
Adams
Brown
Cass
Menard
Macon
Piatt
Pike
Illinois River
Morgan
Sangamon
Ag Watershed Institute
Douglas
Edgar
Moultrie
Mississippi River
Shelby
Scott
Prairie Power
Greene
Macoupin
EIU
Clark
Calhoun
Illinois River
Christian
Coles
Montgomery
Cumberland
Jersey
Major Roads
Madison
Mississippi River
0 10 20 40 Miles
Data Source: USDA, IIRA
Data Current: 2011
Map Created by: A. Rupe, GIS Specialist, IIRA
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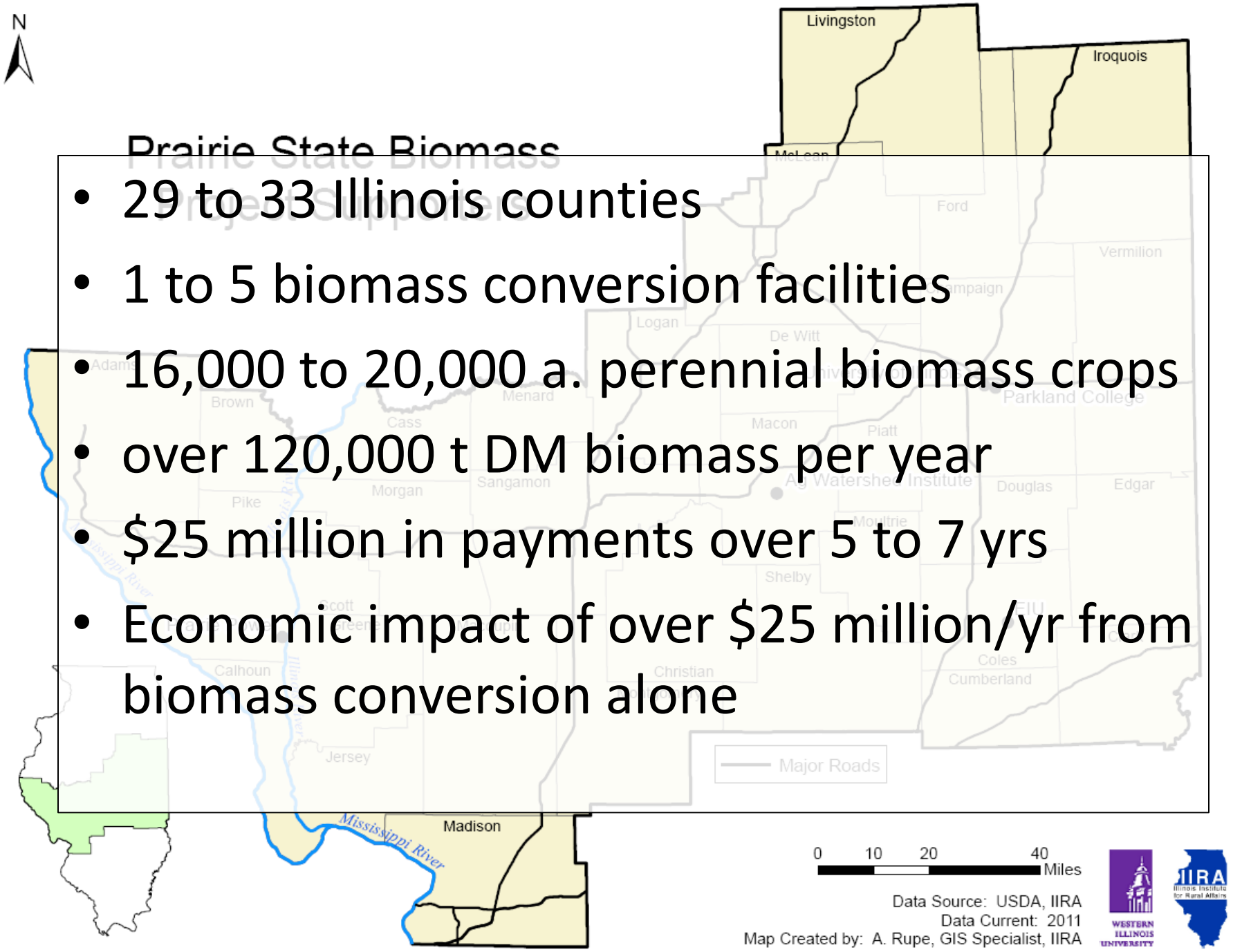


Prairie State Biomass Project Supplement

- 29 to 33 Illinois counties
- 1 to 5 biomass conversion facilities
- 16,000 to 20,000 a. perennial biomass crops
- over 120,000 t DM biomass per year
- $25 million in payments over 5 to 7 yrs
- Economic impact of over $25 million/yr from biomass conversion alone

Prairie State Biomass Project Area

- Potential to jump-start biomass market in Illinois…
- …but needed to jump to make the application deadline.

IIRA

Prairie State Biomass Project Area

PARKLAND COLLEGE

Ray Spencer

Heather Fox

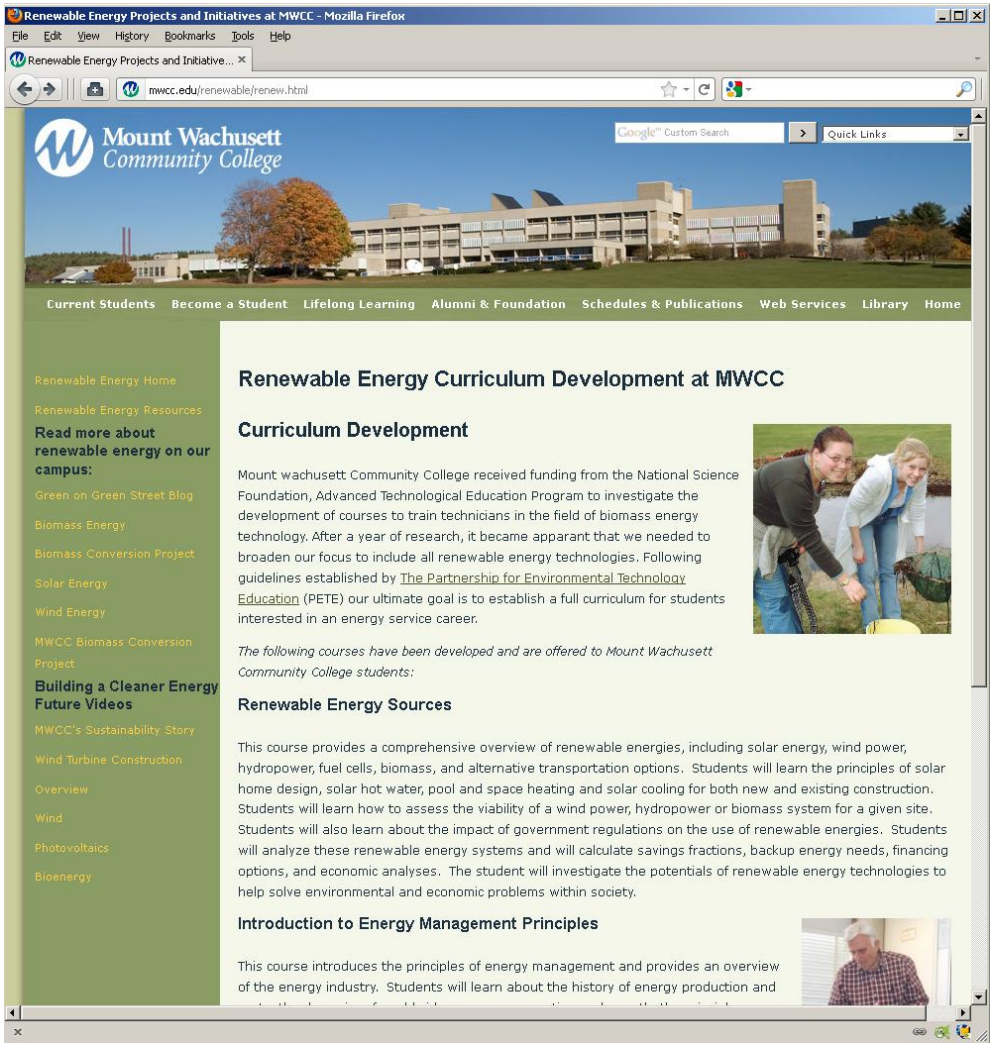
Not pictured:
Josh Birky
Jill Garner

- Support team included Land Grant, 4-yr non-Land Grant, and community college personnel.
- Parkland Grants & Contracts Office played keystone role


Opportunities for teaching

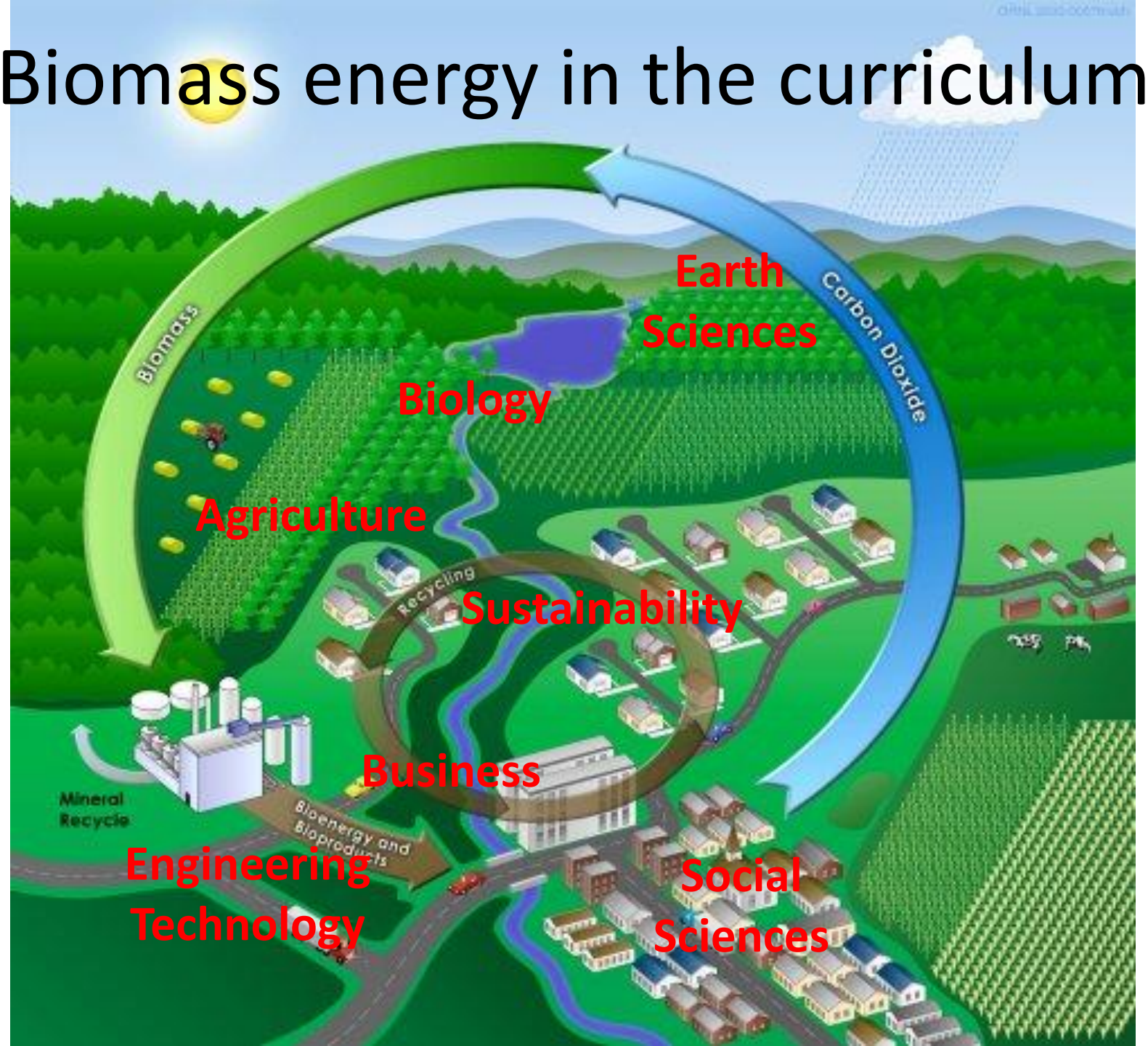
More on Mount Wachusett…

- Leveraged biomass project into new Renewable Energy degree program



…but biomass can fit many places in the curriculum:

Biomass energy in the curriculum



ORNL

AgroKnowledge biofuels curriculum

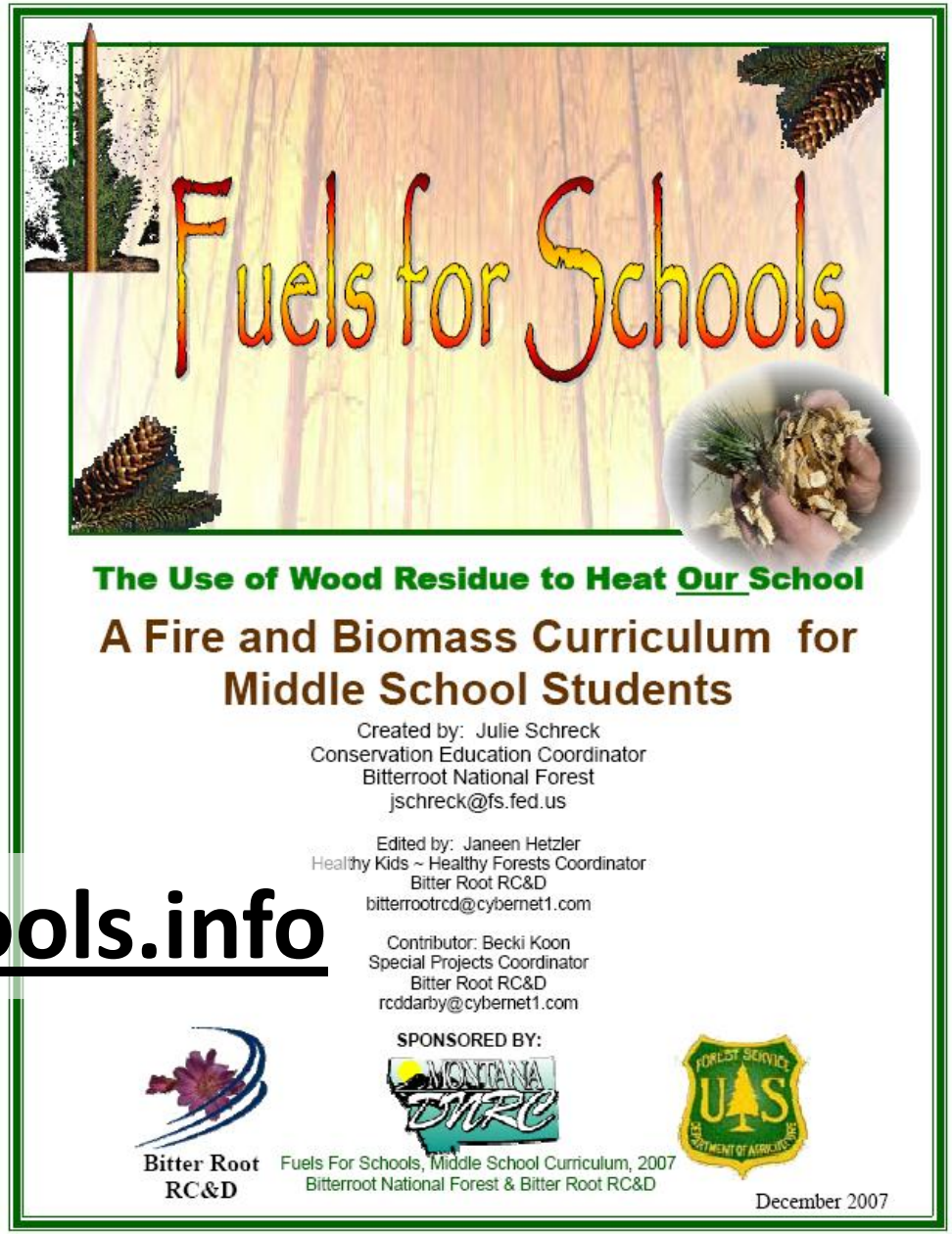
- Designed for college
- Includes unit on biomass gasification
- Paid subscription required.

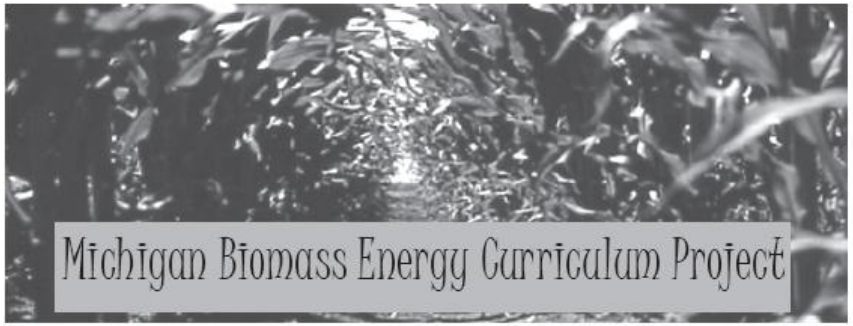
www.AgroKnow.org

USFS Biomass Curriculum

- Developed for middle school; possible to adapt?

www.FuelsforSchools.info





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U.S. Department of Energy
www.energy.gov

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Michigan Department of Labor and Economic Growth: Energy Office
http://www.michigan.gov/cis

Created by:
Michigan Association of Conservation Districts, 2005
www.macd.org

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Special Thanks to the Review Committee.

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Eira McDaniel	Niles High School	Teresa Salveta	MACD
Jeff Auch	Muskegon Conservation District	Greg Mund	USDA-N
Tara Egnatuk	Calhoun Conservation District		

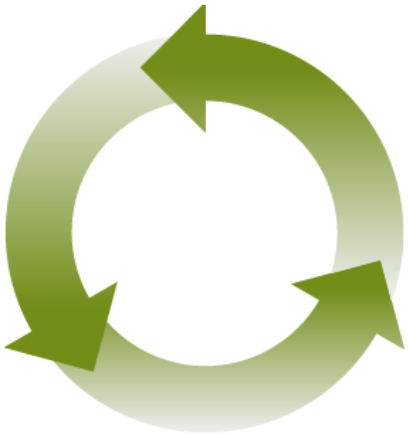
Labor & Economic Growth

Conservation Districts

Michigan Biomass Curriculum

- Developed for K-12; possible to adapt?

http://tinyurl.com/MIBiomassCurriculum



IBWG

Illinois Biomass Working Group

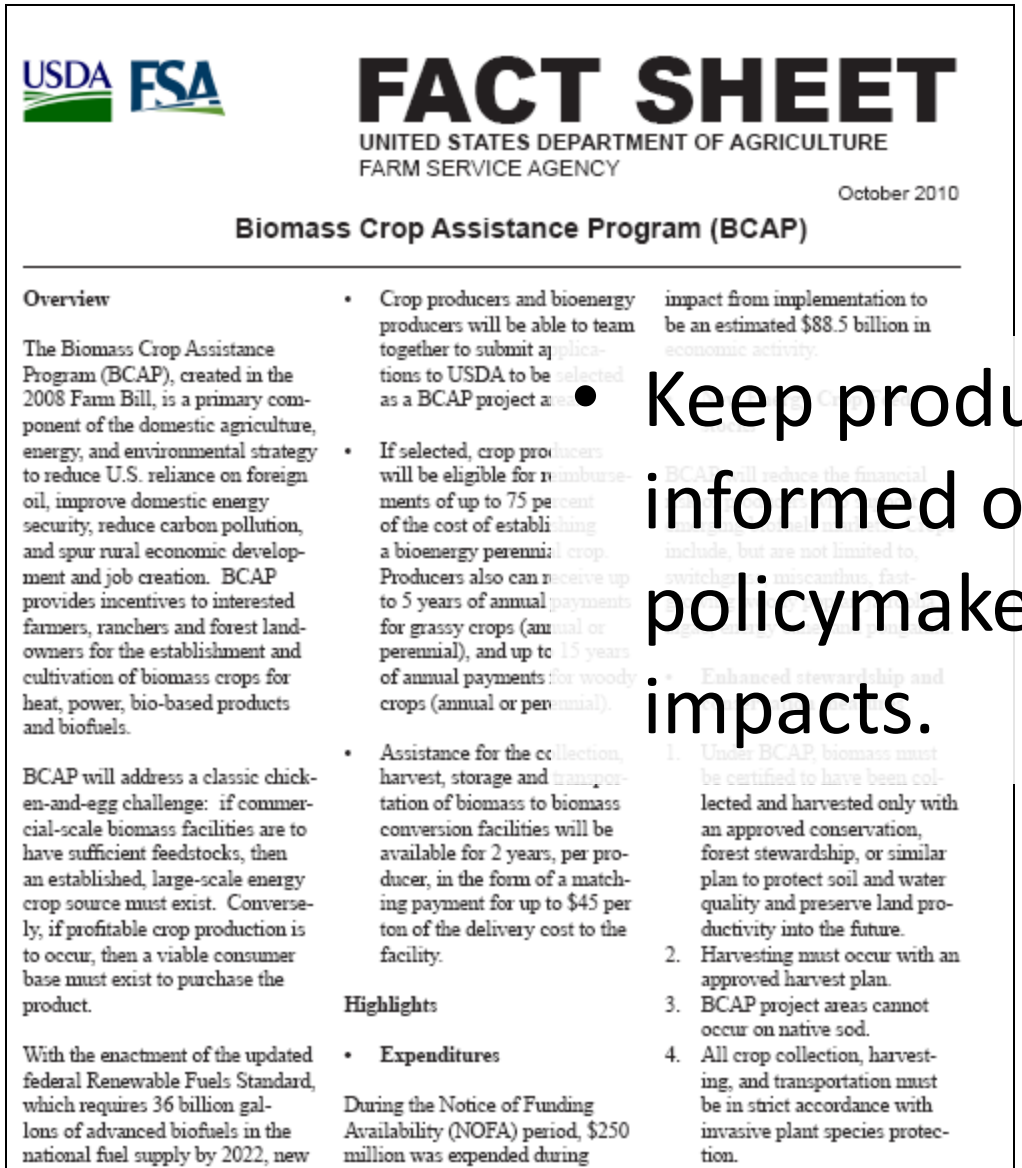
Linking farmers, businesses, researchers, and agencies to accelerate development of a sustainable, profitable biomass energy sector in Illinois.

Participating institutions include:

IBWG's biomass to-do list:

- Link existing and potential buyers and sellers; help create complete biomass supply chains.

IBWG's biomass to-do list:



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- Keep producers & end users informed of key incentives; help policymakers assess needs and impacts.

IBWG's biomass to-do list:

- Benchmark existing technologies & feedstocks and work toward standard specifications.

UIUC

Metro Planning Council

- Create dialogue to help regulatory processes be effective & efficient for all parties.

IBWG's biomass to-do list:

- Document the development of the biomass industry in Illinois.

IBWG
Illinois Biomass Working Group

www.IllinoisBiomass.org

Illinois Biomass Facility Profiles

Eastern Illinois University
Renewable Energy Center

Charleston, IL

Facility facts

Owner: Eastern Illinois University, Charleston, IL.

Status: Under construction. (Owner estimates startup in April 2011.)

Output: Steam for district heating & cooling, with secondary electrical generation.

Feedstock: 100% virgin wood chips initially

Platform: Gasification.

Information current as of: Nov. 15, 2010

EIU graphic

DRAFT

Facility Profile

Faced with the need to replace a 19xx-vintage coal-fired heating plant nearing the end of its lifespan, EIU is building a new facility powered by biomass. When it comes online in 2011, the EIU Renewable Energy Center will supply 100% of campus heating and cooling needs using two boilers fired by a Chiptec biomass gasifier. The facility will includes a 685 kW steam turbine for electrical co-generation and a backup natural gas / fuel oil system. EIU intends initially to operate the facility using some 27,000 t DM/yr of virgin wood chips, but is interested in other feedstock options for the future, including perennial grass crops and corn stover. The university has entered into an innovative $80 million energy performance contract with Honeywell International to build the plant, in a package the includes over a dozen other green energy measures.

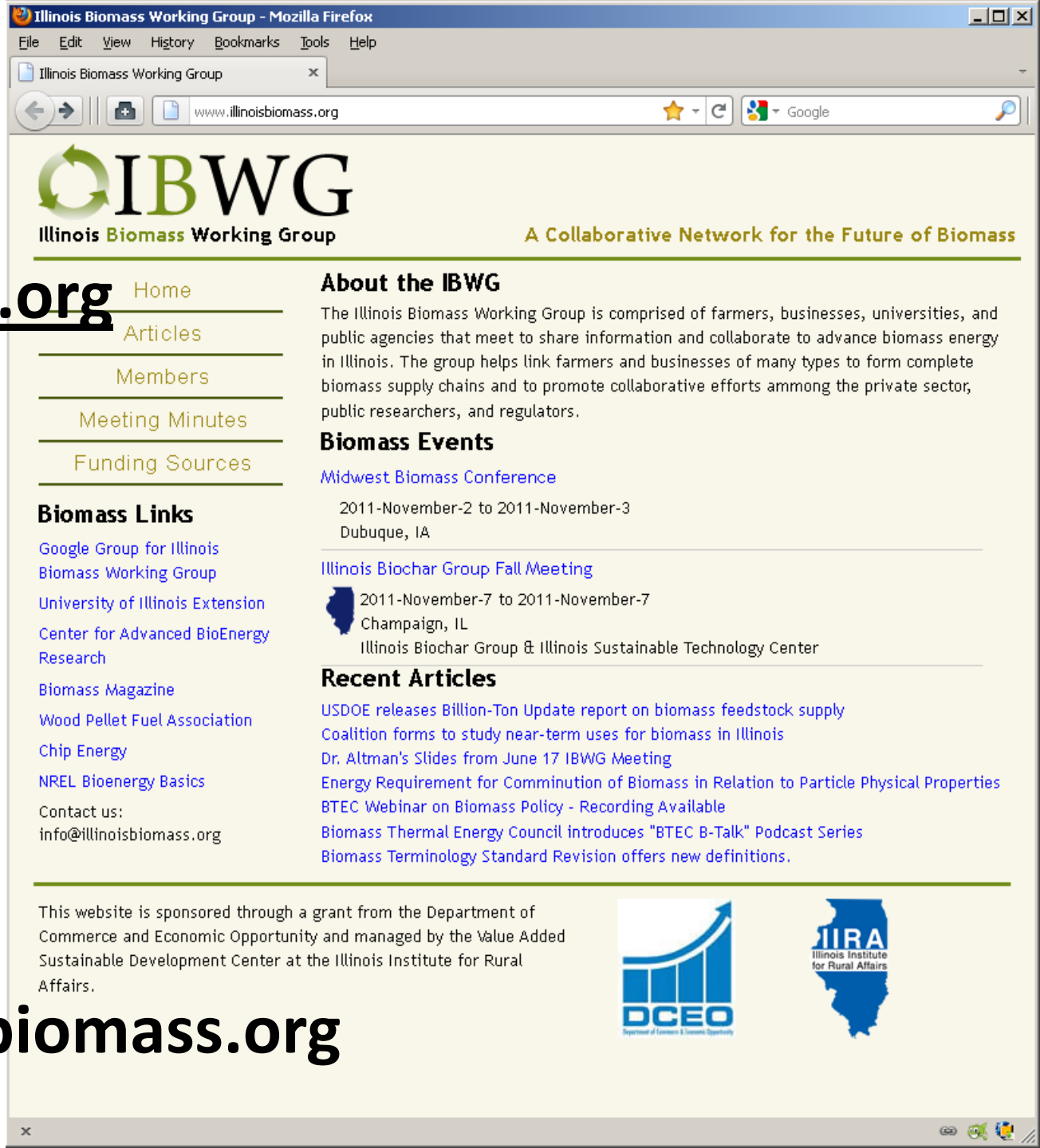
Website

IllinoisBiomass.org

Email list

Contact:

info@illinoisbiomass.org



Grant opportunities

DCEO Renewable Energy Grant Portal provided by IIRA:

IllinoisWind.org/DCEOPortal

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